REMARKS

Claims 1-36 are active in this application. Claims 1, 3 and 15-36 stand withdrawn from consideration.

Applicants wish to than Examiner Piziali for the helpful discussion with Applicant's Representatives on February 21, 2008. The data of the Rule 132 Declaration filed November 13, 2007, were again discussed in detail. The data show that using a microcapsule in the curing agent can delay the time in which the viscosity of the resin composition begins to increase and can lower the minimum viscosity required for the resin to reach the non-impregnated portion.

It appeared that the Examiner has now a better understanding of the invention (especially Figure 3 compared to Figure 5) and of the data in the Rule 132 Declaration. However, the Examiner requested some more clarification.

The Examiner wanted to know where in the specification, the importance of the viscosity is disclosed. There is a disclosure regarding the viscosity at page 20, line 13 to page 21, line 3 and at page 22, line 20 to page 23, line 2, of the specification:

> On the other hand, prepregs must typically display favorable handling characteristics at room temperature. Two major factors in determining the handling characteristics are the tack (the degree of stickiness) and the drape characteristics (the flexibility), and in order to optimize the tack and drape characteristics, the thermosetting resin composition that finctions as the matrix resin must have a viscosity that falls within a certain range. If the viscosity of the thermosetting resin composition is too low, then the tackiness is too powerful, making handling extremely difficult, whereas if the viscosity is too high, then the tackiness is overly weak, and the drape characteristics can effectively disappear, which also makes handling very difficult. Hence, in order to ensure favorable handling characteristics for the prepreg, the thermosetting resin composition must have a viscosity that falls within an appropriate range. Accordingly, if a thermosetting resin composition cures at lower temperatures, then this means that the composition is capable of curing while still at a relatively higher viscosity, and is consequently suitable as a thermosetting resin composition for a prepreg of the second embodiment, which is capable of yielding a favorable molded product even with comparatively poor fluidity.
>
> ....

> When the matrix resin is supplied to the sheet-like reinforcing fiber substrate, it is preferably stuck to the substrate at room temperature, without heating. However, in those cases where the viscosity of the matrix resin at room temperature is very high, the resin may be heated slightly to improve the level of fluidity. However even in such cases, in order to ensure that a continuous resin non-impregnated portion such as that described below is left inside the substrate, any heating is preferably conducted at no more than 40°C, and even more preferably at no more than 30°C.

The Examiner also wanted to have a further explanation of why the data in the Declaration is not expected. Notably, there is nothing in the cited references that would suggest that a lower <u>minimum</u> viscosity is achieved using the microcapsules as in the present invention. This is not expected from the references.

In addition, looking at the two graphs in the Figure of the Rule 132 Declaration, why would it be expected that the <u>viscosity difference</u> between the two samples (the gap between the graphs) changes depending on the temperature. In particular, why would it be expected expected that the viscosity difference between the two samples increases dramatically starting at about 70°C.

Further, there is nothing in the prior art references or catalogues of the microcapsules that would suggest that a low viscosity can be kept for a longer period of time by using the microcapsules. In addiiton, the effect of the microcapsules, which allow the materials to maintain a low viscosity for a longer period of time was found surprisingly when the microcapsules were used for enhancing the storage stability at a low temperature.

Enclosed is a catalogue of the microcapsule (NOVACURE HX-3722) used in the experiment of the Rule 132 Declaration.

The present invention as set forth in **Claim 2** relates to a prepreg, comprising:

reinforcing fiber,

a reinforcing fiber substrate in the form of a sheet and containing reinforcing fiber, and

a matrix resin,

wherein said matrix resin exists on both surfaces of said reinforcing fiber substrate,

wherein a portion inside said reinforcing fiber substrate into which said matrix resin has not been impregnated is continuous, and

wherein said matrix resin comprises a microcapsule based latent curing agent.

Xu (US 6,391,436) in view of Chernack (US 4,808,639) or Sawaoka (US 5,589,523), Hattori (US 5,279,893), Kishi (US 6,045,898) fail to disclose or suggest a prepreg as claimed in which the matrix comprises a microcapsule based latent curing agent as claimed.

A microcapsule based latent curing agent has a structure, in which a membrane covers the curing agent component, and a resin composition including the microcapsule based latent curing agent cures by heating the resin composition to destroy or melt the membrane, so that the curing agent component contacts with the epoxy resin. Namely, curing reaction and increase of the viscosity of the resin composition do not occur until the membrane is destroyed or melted.

Meanwhile, in the partial impregnation prepreg of the present invention and Xu et al. it is necessary for the resin to move to the non-impregnated portion during the curing. In this case, the heavier the weight (g/m^2) of reinforcing fiber substrate used, the larger the non-impregnated portion becomes and the more the movement distance of the resin becomes during the curing. In fact, a molded product without voids can not be produced without keeping the viscosity of the resin low during the curing, because the resin can not reach the non-impregnated portion.

The Rule 132 Declaration filed November 13, 2007, shows the changes of the viscosity of the resin composition relative to an increase of temperature during the curing.

Xu, Chernack, Sawaoka, Hattori, Kishi, alone or in combination do not disclose or suggest the superior results obtained when using a prepreg as claimed in which the matrix comprises a microcapsule based latent curing agent as claimed.

As shown in the Figure of the Declaration, using a microcapsule in the curing agent can delay the time in which the viscosity of the resin composition begins to increase and can lower the minimum viscosity required for the resin to reach the non-impregnated portion. Assuming that a viscosity of less than η is appropriate for the impregnation of the resin, the time to keep the viscosity less than η is longer when using the microcapsule based latent curing agent. As a result, the matrix resin of the present invention can keep a lower viscosity for a long time until the resin is cured, and a molded product without voids can be obtained event if the fiber substrate has a heavy weight (g/m^2).

For further understanding of the invention see for example Figure 3 which illustrates an embodiment of the present invention and compare to Figure 5. In Figure 3, the matrix resin non-impregnated layer 32 is formed as a continuous layer, while in Figure 5 there is a non-continuous non-impregnated layer. See also the discussion of these figures at page 16, starting at line 4 of the specification.

Further, the specification states at page 15, lines 11-18 as follows:

> In a prepreg according to the second embodiment, the portion inside the sheet-like reinforcing fiber substrate into which the matrix resin has not been impregnated must be a continuous portion. In the second embodiment, this non-impregnated portion functions as the deaerating circuit, and the existence of this deaerating circuit means that the molded FRP can be formed without internal voids and surface pinholes. **However, if this deaerating circuit is segmented by the matrix resin, then the air that is enclosed by the matrix resin becomes extremely difficult to remove, and can give rise to internal voids and surface pinholes.**

Chernack or Sawaoka, Hattori, Kishi do not cure the defects of Xu.

Therefore, the rejections of the claims over Xu (US 6,391,436) in view of Chernack (US 4,808,639) or Sawaoka (US 5,589,523), Hattori (US 5,279,893), Kishi (US 6,045,898)

are believed to be unsustainable as the present invention is neither anticipated nor obvious and withdrawal of these rejections is respectfully requested.

Finally, Applicants note that MPEP §821.04 states, "if applicant elects claims directed to the product, and a product claim is subsequently found allowable, withdrawn process claims which depend from or otherwise include all the limitations of the allowable product claim will be rejoined." Applicants respectfully submit that should the elected group be found allowable, the non-elected claims should be rejoined.

In addition, should the elected species be allowable, the Examiner should expand his search to the non-elected species.

This application presents allowable subject matter, and the Examiner is kindly requested to pass it to issue. Should the Examiner have any questions regarding the claims or otherwise wish to discuss this case, he is kindly invited to contact Applicants' below-signed representative, who would be happy to provide any assistance deemed necessary in speeding this application to allowance.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.
Norman F. Oblon

Kirsten Grueneberg

Kirsten A. Grueneberg, Ph.D.
Registration No. 47,297

Customer Number
22850

SHIGA INTERNATIONAL PATENT OFFICE

[Translation of the Catalogue]

NOVACURE HX-3721 and HX-3722

LOW TEMPERATURE RAPID CURABLE GRADE

The following advantages can be obtained by using NOVACURE HX-3721 or HX-3722 in combination with the liquid epoxy resin AER260.

1. Excellent storage stability at a temperature of not more than 50°C.
2. Rapidly curing at a relatively low temperature of 80°C.
3. Excellent heat resistance.
4. Excellent adhesive.
5. Excellent void filling capacity, especially with HX-3722.

Table 1 shows the curing properties when using NOVACURE HX-3721 or HX-3722 as a curable agent in combination with AER260.

Figure 1 shows the temperature dependence of the gel time of each combination.
Figure 2 shows the change of the shear adhesive strength by change of the curing time at a curing temperature of 80°C.

Table1. Curing Properties

Items	Combination No. (wt pts)	1	2
Combination	AER 260	100	100
	NOVACURE HX-3721	28	
	NOVACURE HX-3722		30
Properties of Combinations	Viscosity (cps/25°C)	17,800	18,400
	Storage stability 40 °C × 7 days (times) 50 °C × 7 days (times)	 1.1 1.2	 1.1 1.3
	Gel time	See Fig.1 and 2	
Shear Adhesive Strength (kg/cm^2) Curing at 80 °C for 60 min Curing at 100 °C for 30 min		 118 139	 130 144
Tg (°C), Curing at 100 °C for 30 min		188	186
Electrical Properties, Curing at 80 °C for 60 min			
	Volume Resistance Ratio (Ω·cm) 25 °C 150 °C	 2.9×10^{15} 5.5×10^{12}	 3.6×10^{15} 5.1×10^{12}
	After PCT (120 °C × 20 hours)		
	Water Absorption (%) Volume Resistance Ratio(Ω·cm) at 25 °C	2.5 9.6×10^{13}	2.4 9.8×10^{13}

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Fig.1 Temperature Dependence of Gel time

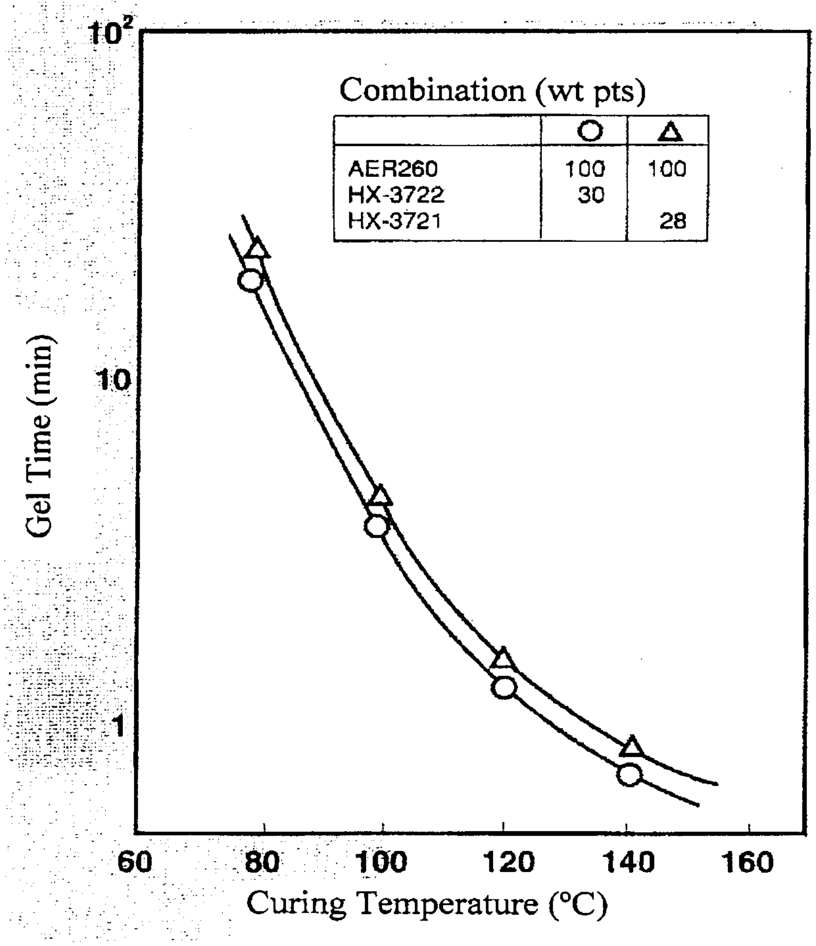
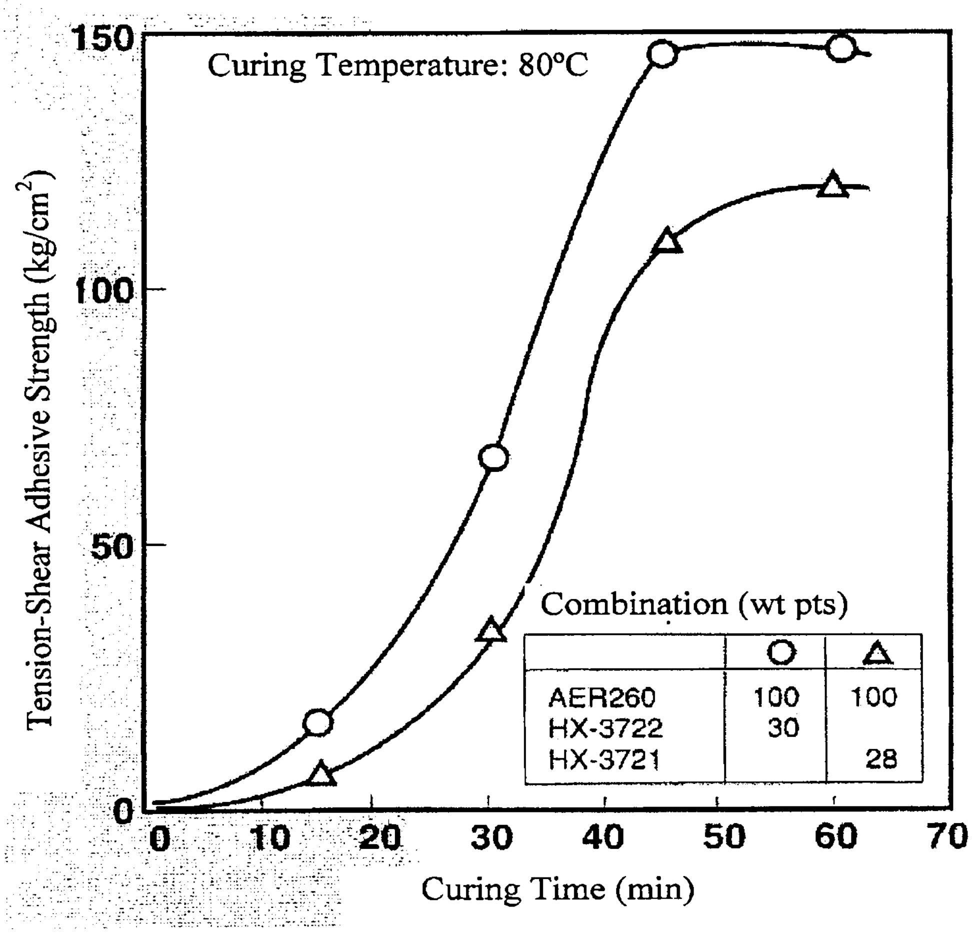


Fig.2 Curing Time Dependence of Shear Adhesive Strength



NOVACURE®
HX-3721
HX-3722

低温速硬化グレード

ノバキュアHX-3721およびHX-3722は、液状エポキシ樹脂AER260と組み合わせて使用した場合、次のような特長が得られます。

1. 50℃以下で優れた貯蔵安定性を持っています。
2. 80℃の比較的低い温度でも速やかに硬化します。
3. 耐熱性に優れています。
4. 接着性に優れています。
5. 特にHX-3722は間隙充填性に優れています。

ノバキュアHX-3721およびHX-3722を硬化剤として、AER260に配合した場合の硬化特性は表1のとおりです。

図1は、各配合物のゲルタイムの温度依存性を示したものです。また図2は、硬化温度80℃で硬化時間を変えた場合のせん断接着強さの変化を示したものです。

図1　ゲルタイムの温度依存性

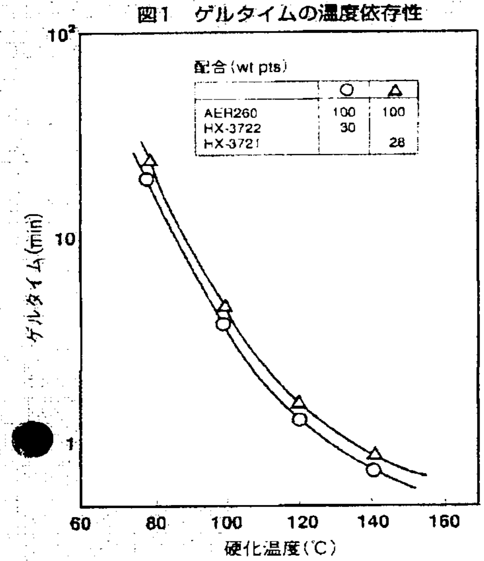


図2　せん断接着強さの硬化時間依存性

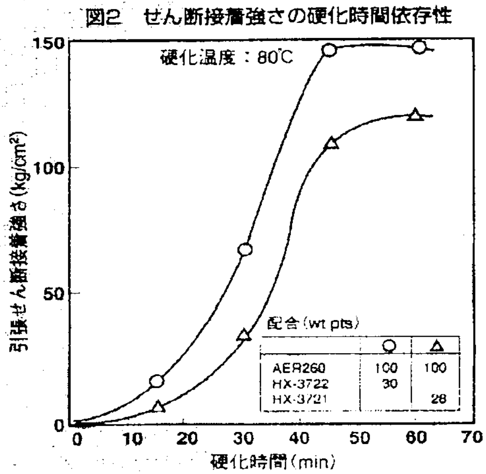


表1. 硬化特性

項目	配合No.(wt pts)	1	2
配合	AER 260	100	100
配合	ノバキュアHX-3721	28	
配合	ノバキュアHX-3722		30
配合品の特性	粘度 (cps／25℃)	17,800	18,400
配合品の特性	貯蔵安定性40℃×7日 (倍) 50℃×7日 (倍)	1.1 1.2	1.1 1.3
配合品の特性	ゲルタイム	左図参照	
せん断接着強さ (kg／cm²) 80℃×60分硬化 100℃×30分硬化		 118 139	 130 144
Tg (℃) 100℃×30分硬化		188	186
電気特性 80℃×60分硬化			
	体積抵抗率 (Ω・cm) 25℃ 150℃	2.9×10^{15} 5.5×10^{12}	3.6×10^{15} 5.1×10^{12}
	PCT (120℃×20時間) 後		
	吸水率 (%)	2.5	2.4
	体積抵抗率 (Ω・cm) 25℃	9.6×10^{13}	9.8×10^{13}